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EVALUATION OF MODIFIED PREPRODUCTION MODEL OF 3000-METER SURFAC--ETC(U)
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(9) service test report (6) **Evaluation of Modified Preproduction Model of 3000-Meter Surface-Vessel Bathythermograph OC-6/S**

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Evaluation of this equipment was completed October 1953. The report was approved for publication 18 December 1953. The work was done under ST-12 (NEL 4G10).

STATEMENT OF PROBLEM

Conduct engineering tests and evaluation of modified 3000-Meter Surface Vessel Bathythermograph OC-6/S to determine acceptability for Naval use.

CONCLUSIONS

The bathythermograph meets the requirements of the specification except for three minor discrepancies:

1. The sound velocity grid is marked every 5 meters per second instead of every 2 meters per second.
2. A pen lifter instead of a pen stop is provided for high-temperature protection.
3. The full range of pen travel is only about 94 per cent of that required. The temperature calibration is within the specification requirement, but it is believed that the calibration could and should be better.

RECOMMENDATIONS

1. Improve the temperature calibration.
2. Amend the specification to allow the 5-meter marking on the sound velocity grids, and to allow the use of the high-temperature pen lifter.
3. Move the grid nameplate to the high temperature-high pressure corner.

The Laboratory evaluation was conducted by the author with the assistance of Messrs. B. L. Lieb and R. C. Hinck.

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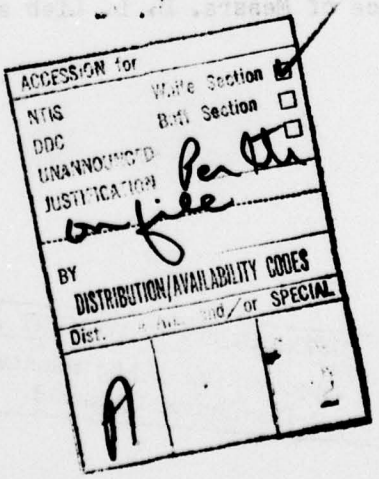
ILLUSTRATIONS



INTRODUCTION

This report covers the testing and evaluation of a modified preproduction model of Surface Vessel Bathythermograph OC-6/S, manufactured by Engineering Laboratories, Inc., Garland, Texas, under contract NObsr-52100. Operational performance, quality of construction, and ease of servicing in the field were evaluated for compliance with the specification.[1]

DESCRIPTION OF EQUIPMENT

The bathythermograph is cylindrical, approximately 9 inches in diameter and 8 inches in over-all length (fig. 1). The total weight is 60 pounds. The instrument consists of a sealed chamber which contains the pressure and temperature Bourdons (fig. 2) and a tail piece that is wrapped with the thermal element tubing (fig. 1). External pressure is admitted to the pressure Bourdon by means of a small screened inlet in the base of the pressure cylinder. The pressure Bourdon (fig. 2) supports a smoked slide and rotates it about the Bourdon axis as a function of the depth. The thermal Bourdon (fig. 2) moves a stylus transversely across the smoked slide as a function of the temperature. The carrying case (fig. 3) has sponge rubber padding to protect the instrument against shock and vibration.

The function of the equipment is to obtain the relationship between temperature and depth which is read by comparing the slide trace with a calibrated grid (fig. 5).

A grid for reading sound velocity as a function of depth is also supplied.

TESTS

The temperature and depth calibrations of the BT were checked in a pressure tank in which the temperature could be controlled. The temperature was measured with a thermistor enclosed in a hydrogen-filled glass envelope. The thermistor and bridge combination was calibrated before and after the tests against a Bureau of Standards certified platinum resistance thermometer. The repeatability of the thermistor and bridge combination is better than $\pm 0.1^{\circ}C$. The depth or equivalent pressure was measured with a Crosby Fluid Pressure Scale which is accurate to ± 1 pound.

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[1] Military Specification MIL-B-15635(SHIPS) Bathythermograph OC-6/S (3000 Meter Surface Vessel Use) 15 August 1950

The BT was subjected to (1) a temperature and depth calibration run, (2) a temperature and depth hysteresis run, (3) 125 per cent of rated pressure, (4) a temperature of 50° Centigrade, (5) one hundred pressure cycles, and (6) another temperature and depth calibration run. These tests provided sufficient data to check the repeatability of the instrument as well as its accuracy.

TEMPERATURE

The upper temperature calibration curve, shown in figure 4, is the line drawn through the middle of all the test points taken at low pressure. All of the low pressure test points were within 0.1°C of this line. The lower curve shows the test points taken at high pressure. There was no change in calibration after exposure to overtemperature and overpressure, nor was there any appreciable temperature hysteresis.

DEPTH

The BT has an average depth error of minus 15 meters over the whole range, the error varying between 0 and minus 30 meters. There was no change after overtemperature and overpressure nor was there any appreciable depth hysteresis.

LIFE TEST

The BT was subjected to one hundred pressure cycles to full rated depth, each sustained at full depth for 1 minute. The calibration was rechecked with no change observed.

SPEED OF RESPONSE

The speed of response of the temperature and depth elements was not checked. The temperature response was found to be within the specification on the previous evaluation.[2] The depth element will obviously meet the response requirements of the specification.

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[2] R. A. Ross Evaluation of Pre-Production Model 3000-Meter Surface-Vessel Bathythermograph OC-6/S (Navy Electronics Laboratory, Report 345) 24 October 1952.

TEMPERATURE COMPENSATION

The instrument without its cover was placed in enough water to cover the thermal tubing, and the temperature allowed to stabilize. Ice-water was then poured inside the instrument around the temperature Bourdon. The position of the stylus before the water was poured in was compared to its position after the water had been in for about 2 minutes. This same process was repeated with hot water. There was no significant difference found.

INSPECTION

The iso-velocity lines on the sound velocity grids are marked in intervals of 5 meters per second instead of the 2 meters as called for in the specification. The 5-meter marking is considered satisfactory because the grid may be read by interpolation to the full accuracy of the instrument.

The resonant frequency of the pressure Bourdon and slide holder was found to be about 50 cps, well above the 35-cps requirement.

The stylus moves an average of 0.70 inch which is less than the required 0.75 inch of travel over the full pressure range. It moves only 1.31 inches instead of the required 1.4 inches over the complete temperature scale. A pen lifter is provided for overtemperature protection instead of a positive stop as the specification calls for.

The BT serial number marking on the grid is in the low pressure-low temperature corner of the grid (fig. 5). While not specifically required by the specification, the marking should be in the high pressure-high temperature corner of the grid so that it will not interfere with the trace.

CONCLUSIONS

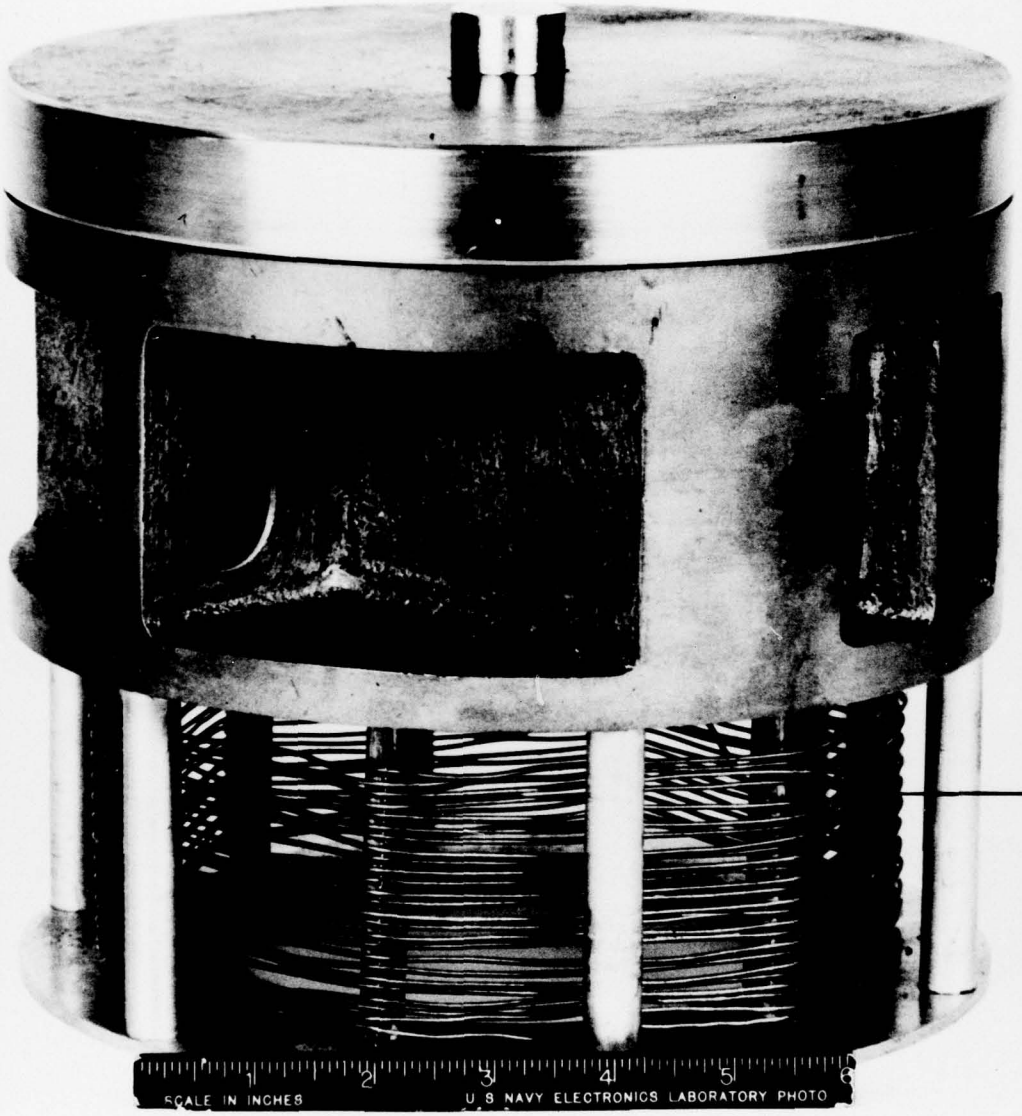
The BT as tested meets the requirements of the specification except for three minor discrepancies:

1. The sound velocity grid is marked every 5 meters per second instead of every 2 meters per second.
2. A pen lifter instead of a pen stop is provided for high-temperature protection.
3. The full range pen travel is only about 94 per cent of that required.

The temperature calibration is within the specification requirement, but is not as good as it probably could be.

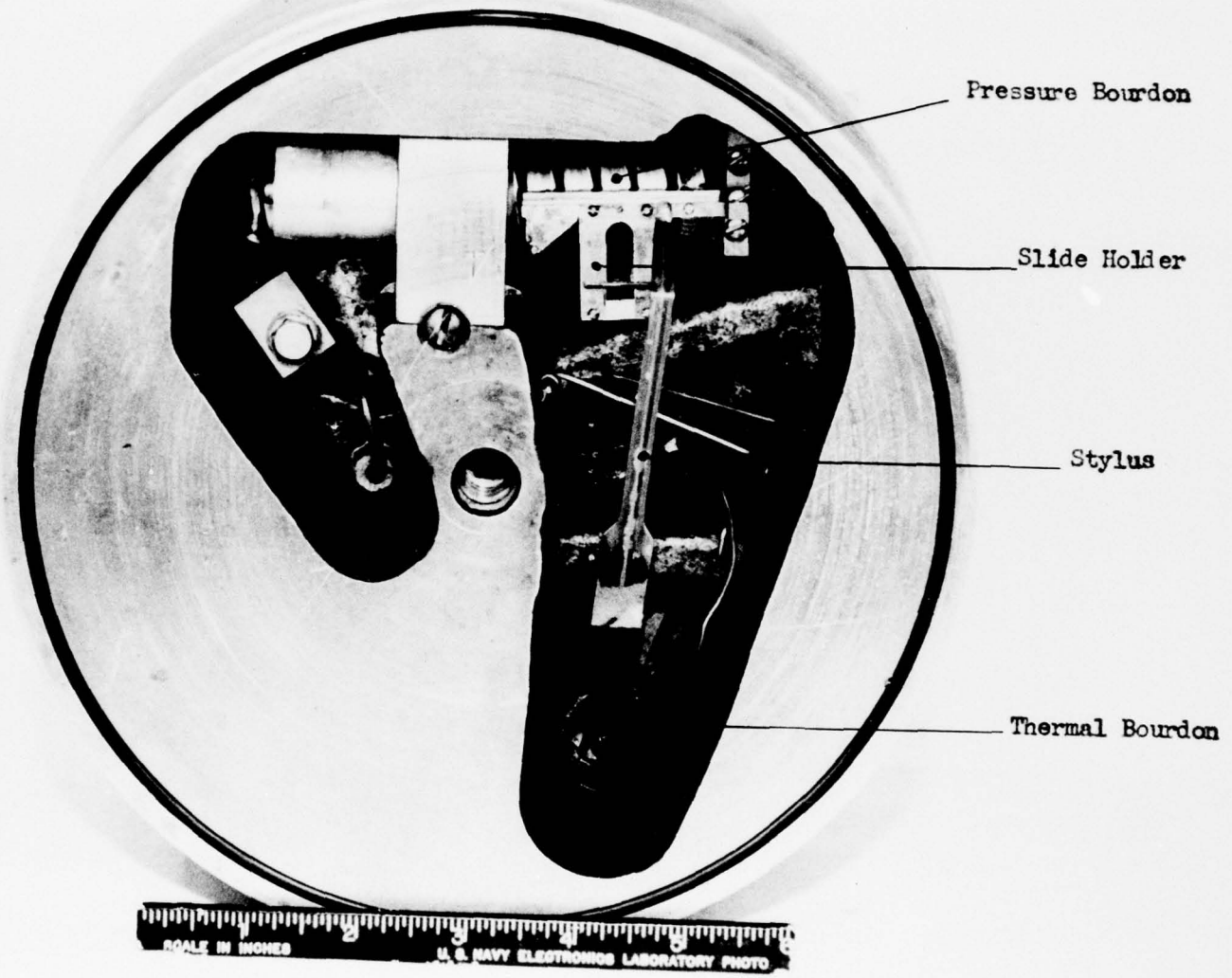
RECOMMENDATIONS

1. Improve the temperature calibration.
2. Amend the specification to allow the 5-meter marking on the sound velocity grids, and to allow the use of the high-temperature pen lifter.
3. Move the grid nameplate to the high temperature-high pressure corner.



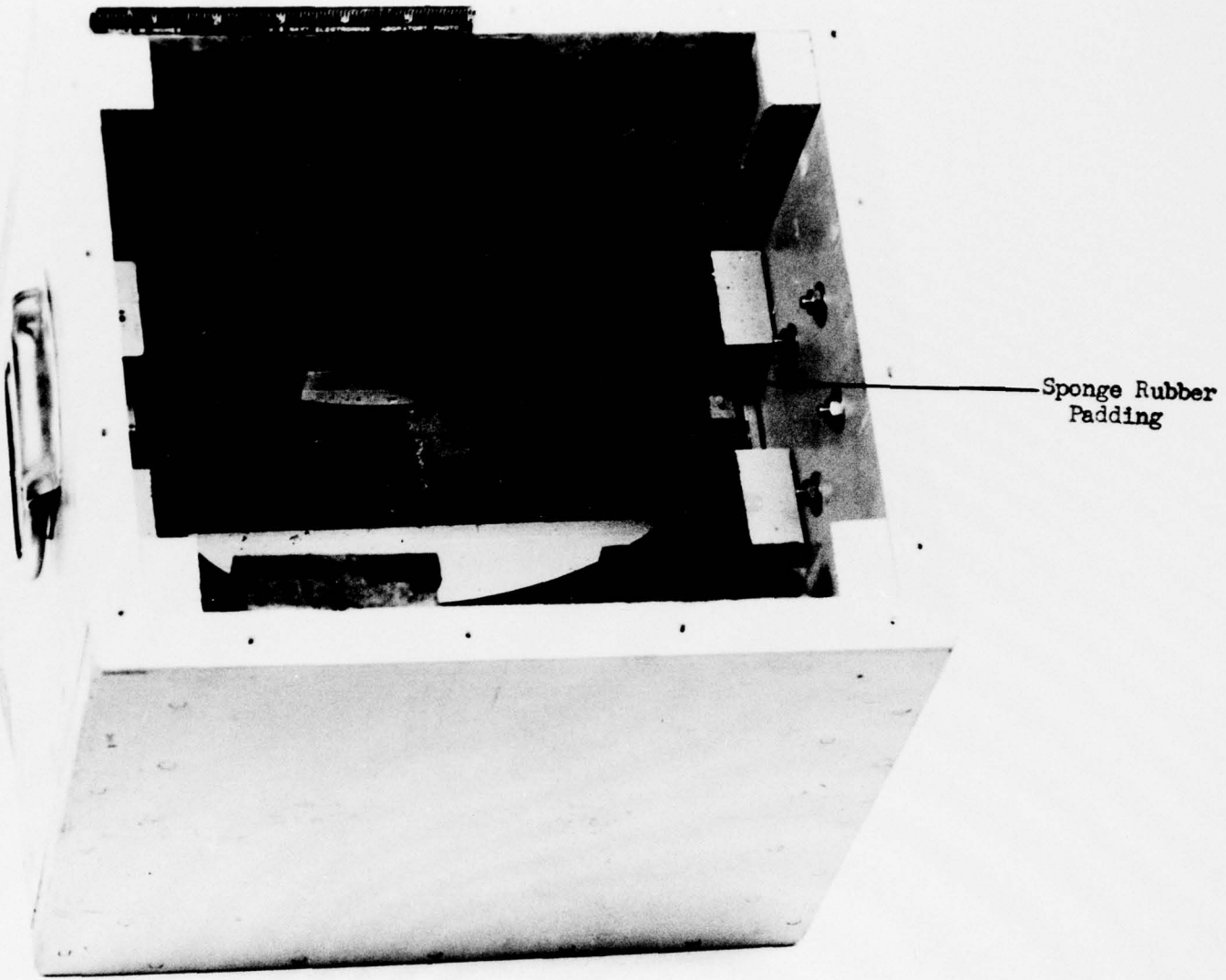
3000 Meter Bathythermograph

Figure 1



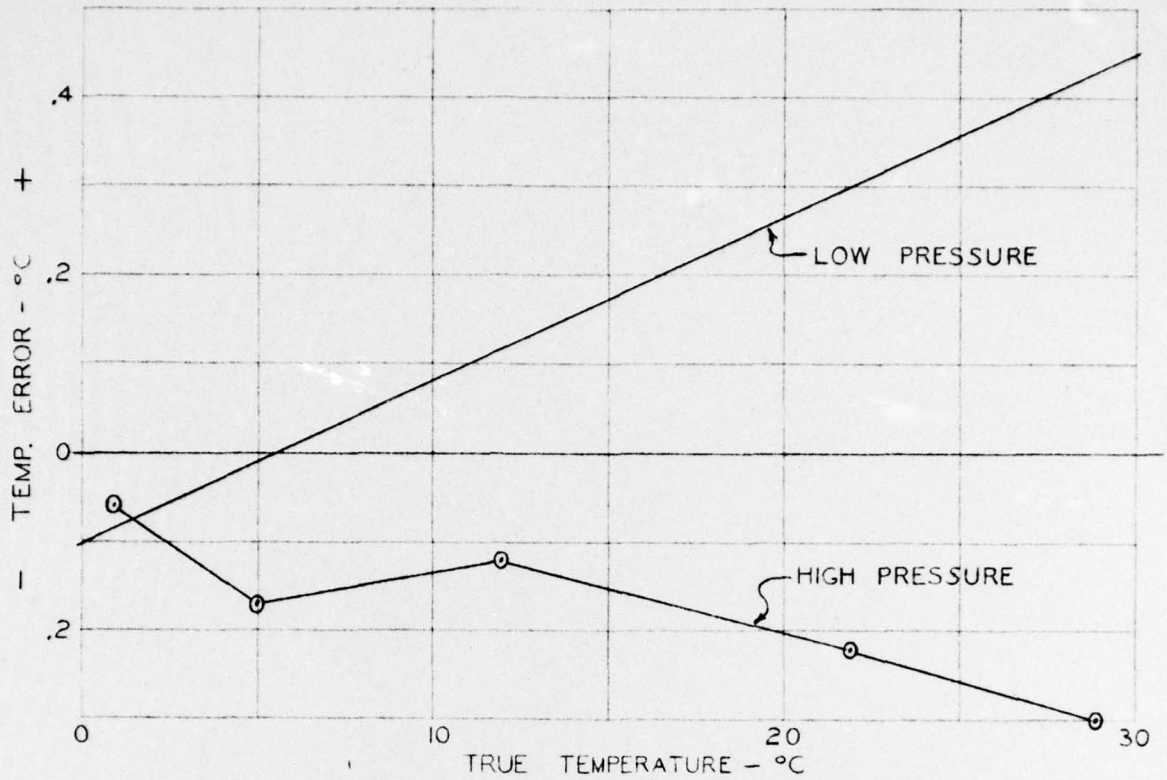
3000 Meter BT Interior

Figure 2



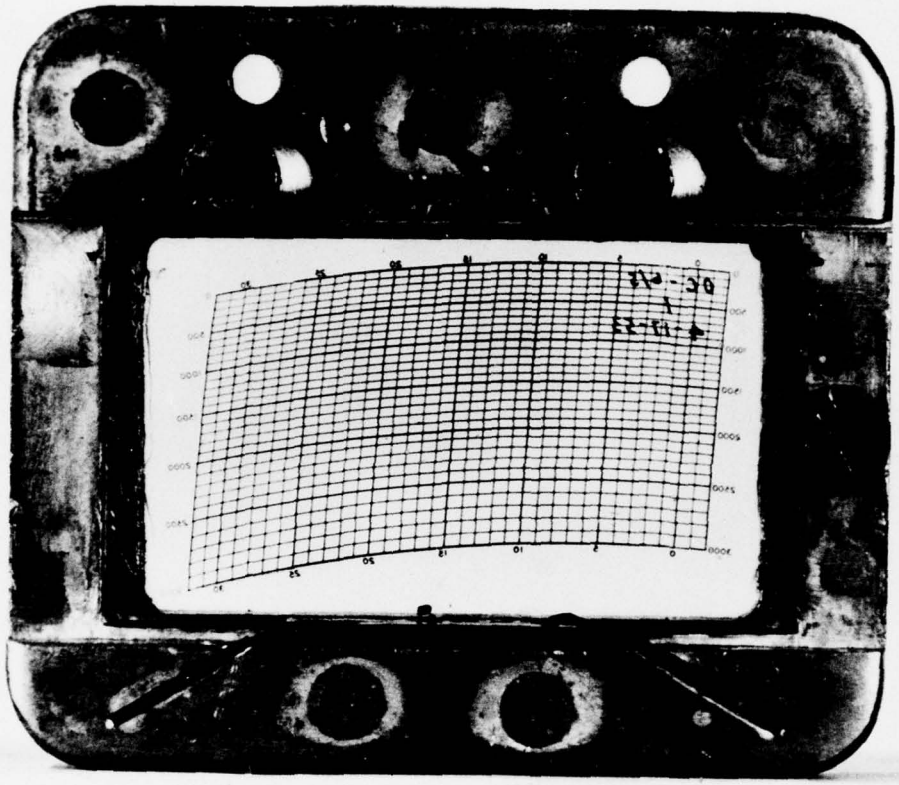
BT Carrying Case

Figure 3



TEMPERATURE CALIBRATION

FIG. 4



Temperature-Depth Grid

Figure 5